19

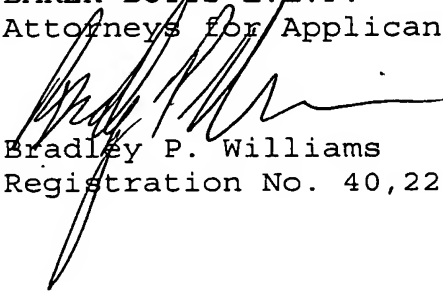## REMARKS

Early and favorable acceptance of this application is respectfully requested. No fees are believed due; however, the Commissioner is authorized to charge any additional fees required by this paper to Deposit Account No. 02-0384 of BAKER BOTTS L.L.P.

Respectfully submitted,

BAKER BOTTS L.L.P.
Attorneys for Applicants

Bradley P. Williams
Registration No. 40,227

Date: June 28 , 2002
2001 Ross Avenue, Suite 600
Dallas, Texas   75201
Phone: 214.953.6447
Fax: 214.661.4447

MARKED UP VERSION OF SPECIFICATION AND CLAIMS

<u>IN THE SPECIFICATION</u>

Page 2, Equation 6, please amend as follows:

$$P_a = \frac{e^{-\bar{x}^{\mathbf{T}} R^{-1} \bar{x}^{|\mathbf{T}|}/2}}{(2\pi)^{M/2}\sqrt{|R|}} \prod_i^m \frac{e^{-[A_i - B_{a(i)} - \bar{x}]^{\mathbf{T}}(P_i + Q_{a(i)})^{-1}[A_i - B_{a(i)} - \bar{x}]^{|\mathbf{T}|}/2}}{(2\pi)^{M/2}\sqrt{|P_i + Q_{a(i)}|}} \tag{6}$$

Page 2, Equation 7, please amend as follows:

$$\delta x_i = A_i - B_{a(i)} - \bar{x}$$
$$S_i = P_i + Q_{a(i)}$$
$$J_a = -\bar{x}^{\mathbf{T}} R^{-1} \bar{x} - \ln[(2\pi)^M |R|] - \sum_{i=1}^m \begin{Bmatrix} \delta x_i^{\mathbf{T}} S_i^{-1} \delta x_i^{|\mathbf{T}|} + \ln[|S_i|] & a(i) \neq 0 \\ g & a(i) = 0 \end{Bmatrix} \tag{7}$$

Page 4, Equation 10, please amend as follows:

$$J_{gnn} = -\sum_{i=1}^m \begin{Bmatrix} [A_i - B_{a(i)}]^{\mathbf{T}} S_i^{-1} [A_i - B_{a(i)}]^{|\mathbf{T}|} + \ln[|S_i|] & a(i) \neq 0 \\ g & a(i) = 0 \end{Bmatrix} \tag{10}$$

Page 6, Equation 12, please amend as follows:

$$\delta f_i^2 = [A_i^f - B_{a(i)}^f]^{\mathbf{T}}(F_{i,a(i)})^{-1}[A_i^f - B_{a(i)}^f]' + \ln(|F_{i,a(i)}|)$$
$$J_{af} = -\bar{x}^{\mathbf{T}} R^{-1} \bar{x} - \ln[(2\pi)^M |R|] - \sum_{i=1}^m \begin{Bmatrix} \delta x_i^{\mathbf{T}} S_i^{-1} \delta x_i^{|\mathbf{T}|} + \ln[|S_i|] + \delta f_i^2 & a(i) \neq 0 \\ g & a(i) = 0 \end{Bmatrix} \tag{12}$$

Pages 6, Equation 17, please amend as follows:

$$J_s - \bar{x}^{\mathbf{T}} R^{-1} \bar{x}^T - \sum_{i=1}^s \begin{Bmatrix} \delta x_i^{\mathbf{T}} S_i^{-1} \delta x_i^{|\mathbf{T}|} + \ln[|S_i|] - \ln(d_{min}) & a(i) \neq 0 \\ \bar{g} & a(i) = 0 \end{Bmatrix} + \begin{Bmatrix} \ln([2\pi]^M |R|) & n_a = 0 \\ 0 & n_a > 0 \end{Bmatrix} \tag{17}$$

IN THE CLAIMS

1. A computerized method for assigning observations comprising:

receiving a plurality of first observations indicative of respective physical parameters observed by a first sensor system and receiving a plurality of second observations indicative of respective physical parameters observed by a second sensor system;

assigning, by a computer, a set of pairs of the first and second observations predicted to correspond to the same physical parameter, the assigning comprising:

receiving a cost function that specifies a cost for each assigned pair, the cost not independent of the assignment of any other assigned pairs in the set of assigned pairs; and

determining the set of assigned pairs corresponding to an optimal value for the cost function by calculating, by the computer, a corresponding optimal value for a directed graph representative of possible assignments of first and second observations.

2. The method of Claim 1, wherein the directed graph comprises a plurality of nodes each representing an assignment hypothesis, the plurality of nodes comprising a root node, wherein each node except for the root node has an associated input arc representing an assignment decision and wherein the length of each input arc is representative of a change in an assignment score resulting from the assignment decision,

wherein the plurality of nodes are grouped in a plurality of stages.

3.   The method of Claim 1, wherein calculating, by the computer, a corresponding optimal value for a directed graph representative of possible assignments of first and second observations comprises calculating the optimal value by a network shortest path algorithm.

4.   The method of Claim 1, wherein calculating, by the computer, a corresponding optimal value for a directed graph representative of possible assignments of first and second observations comprises calculating the optimal value by a Dijkstra algorithm.

5.   (Amended) The method of Claim 1, wherein the cost function is

$$J_s - \bar{x}^T R^{-1} \bar{x}^{[T]} - \sum_{i=1}^{s} \left\{ \begin{array}{cc} \delta x_i^T S_i^{-1} \delta x_i^{[T]} + \ln[|S_i|] - \ln(d_{min}) & a(i) \neq 0 \\ \frac{}{g} & a(i) = 0 \end{array} \right\} + \left\{ \begin{array}{cc} \ln([2\pi]^M |R|) & n_a = 0 \\ 0 & n_a > 0 \end{array} \right\}$$

wherein J_s = Assignment score

$\bar{x}$ = Estimate of relative bias

R   = Relative registration covariance matrix

δx_i = State vector difference = $A_i - B_{a(i)} - \bar{x}$

S_i = Residual error covariance for pair A_i and $B_{a(i)}$

d_{min} = Minimum determinant of a residual error matrix

g = Gate value

M = Number of first observations

n_a = Number of non-zero entries in a

a = Assignment vector: $a_{(i)} > 0 \rightarrow A_i$ is assigned to $B_{a(i)}$

A_i = The plurality of first observations

$B_{a(i)}$ = The plurality of second observations assigned to A_i

6. The method of Claim 5, wherein the relative bias, $\bar{x}$, of the cost function is a simple bias.

7. The method of Claim 5, wherein the relative bias, $\bar{x}$, of the cost function is a functional bias.

8. The method of Claim 1, wherein assigning, by a computer, comprises assigning by a processor operable to execute a computer program stored on a computer readable medium.

9. The method of Claim 1, wherein assigning, by a computer, comprises assigning by an application specific integrated circuit.

10. The method of Claim 1, wherein assigning, by a computer, comprises assigning by a digital signal processor.

11. A computerized method for determining the N-best observation assignments comprising:

receiving a plurality of first observations indicative of respective physical parameters observed by a first sensor system and receiving a plurality of second observations

indicative of respective physical parameters observed by a second sensor system;

determining, by a computer, one or more sets of pairs of the first and second observations predicted to correspond to the same physical parameter, the determining comprising:

receiving a cost function that specifies a cost for each assigned pair;

determining a set of assigned pairs corresponding to an optimal value for the cost function by calculating, by the computer, a corresponding optimal value for a directed graph representative of possible assignments of corresponding first and second observations; and

repeating the determining act until a desired number of best observation assignments is determined.

12. The method of Claim 11, wherein the cost specified by the cost function for each assigned pair is not independent of the assignment of any other assigned pairs in the respective set of assigned pairs.

13. The method of Claim 11, wherein the directed graph comprises a plurality of nodes each representing an assignment hypothesis, the plurality of nodes comprising a root node, wherein each node except for the root node has an associated input arc representing an assignment decision and wherein the length of each input arc is representative of a change in an assignment score resulting from the assignment

decision, wherein the plurality of nodes are grouped in a plurality of stages.

14.   The method of Claim 11, wherein calculating, by the computer, a corresponding optimal value for a directed graph representative of possible assignments of first and second observations comprises calculating the optimal value by a network shortest path algorithm.

15.   The method of Claim 11, wherein calculating, by the computer, a corresponding optimal value for a directed graph representative of possible assignments of first and second observations comprises calculating the optimal value by a Dijkstra algorithm.

16.   **(Amended)** The method of Claim 11, wherein the cost function is

$$J_s - \bar{x}^T R^{-1} \bar{x}^{[T]} - \sum_{i=1}^{s} \left\{ \begin{array}{cc} \delta x_i^T S_i^{-1} \delta x_i^{[T]} + \ln[|S_i|] - \ln(d_{min}) & a(i) \neq 0 \\ \bar{g} & a(i) = 0 \end{array} \right\} + \left\{ \begin{array}{cc} \ln([2\pi]^M |R|) & n_a = 0 \\ 0 & n_a > 0 \end{array} \right\}$$

wherein J_s =   Assignment score

$\bar{x}$ =   Estimate of relative bias

R   =   Relative registration covariance matrix

δx_i =   State vector difference = $A_i - B_{a(i)} - \bar{x}$

S_i =   Residual error covariance for pair A_i and $B_{a(i)}$

d_{min} =   Minimum determinant of a residual error matrix

g =   Gate value

M =   Number of first observations

n_a =   Number of non-zero entries in a

a = Assignment vector: $a_{(i)} > 0 \rightarrow A_i$ is assigned to $B_{a(i)}$

A_i = The plurality of first observations

$B_{a(i)}$ = The plurality of second observations assigned to A_i

17. The method of Claim 16, wherein the relative bias, $\bar{x}$, of the cost function is a simple bias.

18. The method of Claim 16, wherein the relative bias, $\bar{x}$, of the cost function is a functional bias.

19. The method of Claim 11, wherein assigning, by a computer, comprises assigning by a processor operable to execute a computer program stored on a computer readable medium.

20. The method of Claim 11, wherein assigning, by a computer, comprises assigning by an application specific integrated circuit.

21. The method of Claim 11, wherein assigning, by a computer, comprises assigning by a digital signal processor.

22. A system for assigning observations comprising: a computer readable medium; and

a computer program stored on the computer readable medium, the computer program operable, when executed on a processor, to:

receive a plurality of first observations indicative of respective physical parameters observed by a first sensor system and receiving a plurality of second observations indicative of respective physical parameters observed by a second sensor system;

assign a set of pairs of the first and second observations predicted to correspond to the same physical parameter, the assignment comprising:

receiving a cost function that specifies a cost for each assigned pair, the cost not independent of the assignment of any other assigned pairs in the set of assigned pairs; and

determining the set of assigned pairs corresponding to an optimal value for the cost function by calculating, by the computer, a corresponding optimal value for a directed graph representative of possible assignments of first and second observations.

23. The system of Claim 22, and further comprising a processor operable to execute the computer program.

24. The system of Claim 22, wherein the directed graph comprises a plurality of nodes each representing an assignment hypothesis, the plurality of nodes comprising a root node, wherein each node except for the root node has an associated input arc representing an assignment decision and wherein the length of each input arc is representative of a change in an assignment score

resulting from the assignment decision, wherein the plurality of nodes are grouped in a plurality of stages.

25. The system of Claim 22, wherein calculating, by the computer, a corresponding optimal value for a directed graph representative of possible assignments of first and second observations comprises calculating the optimal value by a network shortest path algorithm.

26. The system of Claim 22, wherein calculating, by the computer, a corresponding optimal value for a directed graph representative of possible assignments of first and second observations comprises calculating the optimal value by a Dijkstra algorithm.

27. **(Amended)** The system of Claim 22, wherein the cost function is

$$J_s - \overline{x}^T R^{-1} \overline{x}^{[T]} - \sum_{i=1}^{s} \left\{ \begin{matrix} \delta x_i^T S_i^{-1} \delta x_i^{[T]} + \ln\left[|S_i|\right] - \ln(d_{min}) & a(i) \neq 0 \\ \overline{g} & a(i) = 0 \end{matrix} \right\} + \left\{ \begin{matrix} \ln\left([2\pi]^M |R|\right) & n_a = 0 \\ 0 & n_a > 0 \end{matrix} \right\}$$

wherein
J_s = Assignment score
$\overline{x}$ = Estimate of relative bias
R = Relative registration covariance matrix
δx_i = State vector difference = $A_i - B_{a(i)} - \overline{x}$
S_i = Residual error covariance for pair A_i and $B_{a(i)}$
d_{min} = Minimum determinant of a residual error matrix
g = Gate value
M = Number of first observations
n_a = Number of non-zero entries in a

a = Assignment vector: $a_{(i)} > 0 \rightarrow A_i$ is assigned to $B_{a(i)}$

A_i = The plurality of first observations

$B_{a(i)}$ = The plurality of second observations assigned to A_i

28. The system of Claim 27, wherein the relative bias, $\bar{x}$, of the cost function is a simple bias.

29. A system for assigning observations comprising: a computer operable to receive a plurality of first observations indicative of respective physical parameters observed by a first sensor system and receiving a plurality of second observations indicative of respective physical parameters observed by a second sensor system; and

wherein the computer is further operable to assign a set of pairs of the first and second observations predicted to correspond to the same physical parameter, the assignment comprising:

receiving a cost function that specifies a cost for each assigned pair, the cost not independent of the assignment of any other assigned pairs in the set of assigned pairs; and

determining the set of assigned pairs corresponding to an optimal value for the cost function by calculating, by the computer, a corresponding optimal value for a directed graph representative of possible assignments of first and second observations.

30. The system of Claim 29, wherein the computer comprising an application specific integrated circuit.

31. The system of Claim 29, wherein the computer comprises a processor operable to execute a computer program stored on the computer readable medium.

32. The system of Claim 29, wherein the computer further comprises the computer readable medium.

33. The system of Claim 29, wherein the computer comprises a digital signal processor.

34. The system of Claim 29, wherein the computer comprises a field programmable gate array.

35. The system of Claim 29, wherein the computer comprises a means for computing.

36. The system of Claim 29, wherein the directed graph comprises a plurality of nodes each representing an assignment hypothesis, the plurality of nodes comprising a root node, wherein each node except for the root node has an associated input arc representing an assignment decision and wherein the length of each input arc is representative of a change in an assignment score resulting from the assignment decision, wherein the plurality of nodes are grouped in a plurality of stages.

37. The system of Claim 29, wherein calculating, by the computer, a corresponding optimal value for a directed graph representative of possible assignments of first and second observations comprises calculating the optimal value by a network shortest path algorithm.

38. The system of Claim 29, wherein calculating, by the computer, a corresponding optimal value for a directed graph representative of possible assignments of first and second observations comprises calculating the optimal value by a Dijkstra algorithm.

39. **(Amended)** The system of Claim 26, wherein the cost function is

$$J_s - \bar{x}^{\mathrm{T}} R^{-i} \bar{x}^{[\mathrm{T}]} - \sum_{i=1}^{s} \left\{ \begin{array}{cc} \delta x_i^{\mathrm{T}} S_i^{-1} \delta x_i^{[\mathrm{T}]} + \ln\left[\|S_i\|\right] - \ln(d_{\min}) & a(i) \neq 0 \\ \overline{g} & a(i) = 0 \end{array} \right\} + \left\{ \begin{array}{cc} \ln\left(\left[2\pi\right]^M |R|\right) & n_a = 0 \\ 0 & n_a > 0 \end{array} \right\}$$

wherein J_s =   Assignment score

$\bar{x}$ = Estimate of relative bias

R   = Relative registration covariance matrix

δx_i = State vector difference = $A_i - B_{a(i)} - \bar{x}$

S_i = Residual error covariance for pair A_i and $B_{a(i)}$

d_{min} = Minimum determinant of a residual error matrix

g = Gate value

M = Number of first observations

n_a = Number of non-zero entries in a

a = Assignment vector: $a_{(i)} > 0 \rightarrow A_i$ is assigned to $B_{a(i)}$

A_i = The plurality of first observations

$B_{a(i)}$ = The plurality of second observations assigned to A_i

40. The system of Claim 39, wherein the relative bias, $\bar{x}$, of the cost function is a simple bias.